The Harstad Injury Prevention Study. A DECADE OF COMMUNITY-BASED TRAFFIC INJURY PREVENTION WITH EMPHASIS ON CHILDREN. POSTAL DISSEMINATION OF LOCAL INJURY DATA CAN BE EFFECTIVE.

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ABSTRACT

Objectives. To evaluate the outcome of a community-based program for reducing traffic injury rates with special focus on children and to assess the impact of a Traffic Injury Report (TIR) in terms of awareness and attitudes about safety issues.

Setting. The Norwegian cities Harstad (23 000) and Trondheim (140 000), during ten years.

Methods. The outcome was evaluated using hospital-based injury recording. Sustainability of the prevention program was promoted by disseminating information on the community's traffic injury profile. Reports containing information about traffic injuries were distributed quarterly to all Harstad households, containing victim stories and statistics on medical data and the location of the accidents. The impact of the reports was evaluated, using a questionnaire mailed to persons 18-80 years old.

Results. From the first two years (mean rate 116.1/10 000 person years), to last two years, a significant 59% [confidence interval (CI): 42% to 71%] reduction of traffic injury rates was observed for Harstad children. Overall rates for all ages decreased 37% [CI:47% to 24%] in Harstad and increased by 3% [CI:-4% to 10%] in Trondheim (reference city). Significantly higher scores were found in Harstad compared to Trondheim concerning the awareness of, and positive attitudes towards, safety issues (e.g. alcohol and driving, speeding and children's safety in traffic). 56.0 % of respondents in Harstad reported having acquired information, or good advice, about traffic safety from the reports.

Conclusions. Traffic injuries in children can be prevented by community-based interventions. Distributing written information may enhance the program's sustainability.

Key words: Traffic, Injury, Prevention, Community, Children.

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INTRODUCTION

Prevention of road traffic injury has, in some studies using a comprehensive community-based program (1-4), proven successful. The Harstad Injury Prevention Study (HIPS) reported significant traffic injury rate reductions in Harstad, Norway (23 000 inhabitants) for child pedestrians and bicyclists (3,4). One of many interventions was the distribution of a newsletter, **T**raffic **I**njury **R**eport (TIR), disseminating information on local injury rates, numbers, places of occurrence and victim stories. The positive impact of victim stories on accident-related behaviour has been previously reported (5). However, written material distributed to influence driving was found ineffective in California (6) and another purely educational program targeting child pedestrians also had a questionable effect (7). Written information and educational campaigns promoting health were effective when integrated into a Norwegian community program (8).

The Cochrane Collaboration has initiated systematic reviews of injury prevention to make information on effective strategies available to clinicians, program directors and policy-makers (9). Some of the recommended strategies for child pedestrian injury prevention were used in the Harstad study.

Interventions can be characterised as being either "passive", or "active". Passive interventions require little individual action on the part of those being protected - i.e. automobile airbags. The active interventions aim at changing behaviour and require more participation from the individual. However necessary, they are said to be "less effective" than passive ones (10). The theoretical basis for promoting safe traffic behaviour includes the **K-A-P** model, **K**nowledge of, **A**ttitudes towards and **P**ractice of a particular behaviour (11), and the social cognitive model of Bandura (12) with emphasis on self-efficacy. The K-A-P model has been widely criticised. Attitudes toward traffic safety may not change as a result of information given. More likely, a change in behaviour may be brought about by passive interventions, such as automatic speed control by photo boxes. There is little evidence supporting the argument that stand-alone information campaigns can change attitudes and subsequently bring about safer behaviour in traffic (13). A major element in the Bandura model is to support the belief in self-coping skills, at both individual and community levels. This is related to the idea of community empowerment described in the World Health Organisation (WHO) Ottawa Charter.

The Harstad WHO Safe Community initiated interventions in 1988 that combined the efforts of an injury prevention group, health services, and public and private organisations, including educational institutions, road planners and builders, national laws mandating safety equipment and a media campaign. The TIR system was designed to be the driving force behind a long-term program sustained by the distribution of local traffic injury data. The aims of this information were to promote changes towards a safer physical environment and to bring about changes in accident- and injury-related behaviour in

Table I. Interventions weighted by study period* and classified by strategic model**.

Interventions	**Implemented in period*** (weighted) 1	2	3	4	**Active/passive model****
Injury prevention group activity	+	++	+++	++	active and passive
Traffic injury report		+	++	+++	active, may lead to passive
Items in local media promoting traffic safety	+	++	+++	++++	active, may lead to passive
Counselling to increase parental vigilance towards small children in traffic, educating children	+	++	++	++	active
Answering requests for local data from school districts, city planners, private and public organisations		+	+	++	active, may lead to passive
Speeches to Lions, Rotary, schools, police, automobile societies. Face-to-face contacts at health fairs and shopping-centres		++	+++	+++	active
Local restrictions on beer sale in grocery stores and curfews for serving alcohol in bars and restaurants.	+	+	+	+	passive
Media campaign initiated from local accident data for building of separate pedestrian and cyclist roads, lowering of speed limits, intervention in black spots		+	+	++	active, may lead to passive
Building of separate pedestrian and cyclist roads, lowering of speed limits, installing road-bumps, intervention in black spots		+	++	+++	passive
Using local data to inform motor cycle clubs, primary and secondary schools, youth clubs and driving schools to modify behaviour		+	++	++	active
Checks on vehicles (e.g. brakes, steering, lights, tires) and speed limit enforcement by police and traffic authorities	+	++	++	++	passive
Installation of additional high-mounted stop lights			+	++	passive
National law, making local community health authorities responsible for accident injury prevention.		+	+	+	passive

* Each study period 30 months.
** Robertson 1984 (ref. 10).

the Harstad community. A detailed description of the interventions has been reported earlier (3,4). An outline of these interventions is shown in Table I.

An important aspect of injury control research is finding out "what works". Many different interventions were chosen in Harstad because of previously proven efficacy. They were metaphorically thrown into the black box. Because the intervention had many facets and lacking resources for process evaluation, it was nearly impossible to evaluate causal processes to find out what effects did, or did not, come about (3,4). This inability to find out what processes occurred in the black box is a characteristic of many other community-based interventions. Moreover, community interventions tend to be short-term projects with little information on long-term outcomes. The present study adds some new information by reporting long-term results. In addition, it looks at some processes in the black box and evaluates the impact of postal safety information (TIR).

The aims of the present study are to report (i) the long-term outcome of the total prevention program in terms of traffic injury rates, both for all ages and for children, (ii) data about knowledge and attitudes in Harstad and a reference city, (ii) preferences in the population for data, and (iii) the impact of a traffic safety brochure.

MATERIAL AND METHODS

The design of this study was quasi-experimental (14). The baseline period was 2 $^1/_2$ years with no intervention in Harstad other than normal "business as usual" traffic safety promotion. Two Norwegian hospitals (Harstad and Trondheim) have, since 1 July 1985, contributed injury data to a national injury surveillance system developed in co-operation with the National Institute of Public Health (15). A modified version of the Nordic coding system was used (16). Due to the availability of data, Trondheim could serve as a reference city.

An injury form was completed in the Harstad emergency room on all injured patients, whether treated as outpatients, or admitted. Data was provided partly by the patient, or by someone accompanying him/her, and partly by the staff. Information was coded by an injury secretary and computerised. Patient lists in the emergency room were checked daily, or after every weekend, to ensure that missing forms were completed.

Data recording procedure, validity and reliability

The recorded variables, the data recording procedure and the measures taken to ensure data validity and reliability have been described in more detail previously (3).

The **T**raffic **I**njury **R**eport (TIR) system

A quarterly report with detailed information about every hospital-treated traffic injury in the city was published. The TIR contained the time, the location (4,17) and a description of the event. The victim was described in terms of road-user group, injury type and severity. From 1989 the TIR was distributed quarterly to members of the injury prevention group and to private and public organisations participating in the program, including all schools (3-4). From 1992, the newsletter was distributed to all Harstad households (N=9300) at a cost of 2000 US $ per issue, covered by an insurance company.

The survey

The impact of the TIR system was investigated in a cross-sectional postal survey, conducted during the first half of 1994, in Harstad. The questionnaire was pilot-tested on 60 first-year college students. Thereafter, the Norwegian Bureau of Statistics drew a sample of 3000 persons aged 18-80 years, 1500 from each of the two cities Harstad (total population: 23 000) and Trondheim (total population: 140 000). This Bureau and the Institute for Community Medicine, Tromsø University, mailed the invitations to participate. The survey consisted of (i) questions for both populations about knowledge and attitudes connected to some traffic safety items, (ii) questions about the importance of traffic safety information given at different administrative levels (school district, municipality, county and national) and (iii) questions to Harstad residents about the influence of the TIR on the frequency of discussions in the family, or among friends, about problems connected with driving and alcohol, drugs, speeding and children's safety in traffic.

Statistics

For database handling, Epi info version 5.01 was used (18). The χ^2-test was used for comparing rates. 95 % confidence intervals (CI) are given. To control for the confounders age, gender and level of education, the logistic regression analysis in the SPSS statistical package was used (19).

RESULTS

1. Injury rates

Overall traffic injury rates (all ages) for Harstad and the reference city Trondheim are shown in Table II, dividing the decade in four equal periods of 2.5 years. From period 1 to period 4, the rates decreased by 37 % in Harstad [CI:26% to 46%] and increased by 5 % in Trondheim [CI:-1% to 11%].

Table II. Overall traffic injury rates for all ages for Trondheim (reference) and Harstad (intervention) during a decade from 1. July 1985. Mean rates for 2.5-year periods are shown*.

	Trondheim					Harstad				
	Number of injured	Person years	Rate**	RR†	CI†† for Rate	Number of injured	Person years	Rate	RR	CI for Rate
Period 1	1953	335937	58.14	1.00	-	380	54940	69.17	1.00	-
Period 2	1913	340798	56.13	0.97	52.9-59.9	323	55747	57.94	0.84	48.9-67.1
Period 3	2513	346361	72.55	1.25	68.0-76.7	286	56160	50.92	0.74	43.6-59.5
Period 4	2161	354308	60.99	1.05	57.6-64.5	248	56920	43.58	0.63	37.4-51.2

* 2.5-year intervals were used because Harstad baseline (no intervention, just registration) was 2.5 years.
** Per 10 000 person years.
† Relative Risk.
†† 95 % confidence interval.

Long-term effects on children's traffic injury risk in Harstad

The children's yearly traffic injury rates and yearly counts by road-user groups are shown in Figure 1. Bicyclist injuries, particularly to the head, were prevalent. This was a sound argument for promoting bicycle helmet use. Comparing the rate of the first two baseline years (11.6 per 1000 person years) with the last two years of the intervention period (4.8 per 1000 person years), a 59% [CI: 42% to 71%] reduction in injury rates was observed. Correspondingly, in the reference city Trondheim, the overall traffic injury rate for all ages did not change significantly, increasing by 3% [CI:-4% to 10%].

2. The survey

The response rates were 47.7 % in Trondheim and 48.2 % in Harstad after two requests for a reply.

Knowledge and attitudes

Discussions about three traffic safety issues were significantly more prevalent in Harstad compared with the reference city (Table III).

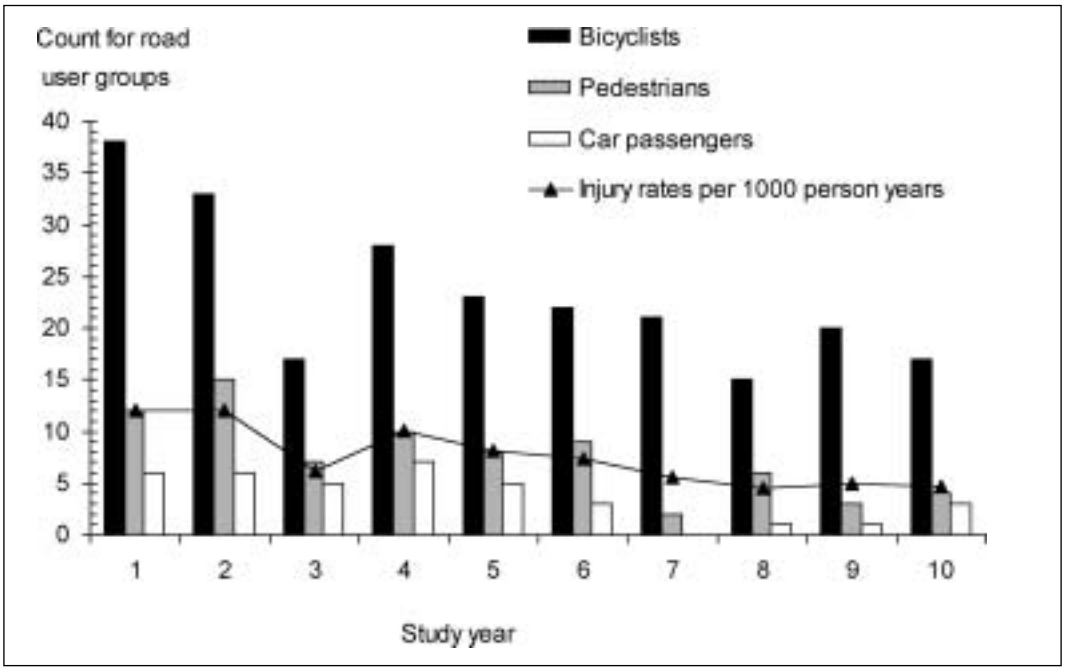

Figure 1. Traffic injury counts (since 1985) by road-user groups and injury rates for 0- to 15-year-old Harstad children.

However, when adjusting for confounders, the difference was not significant on the variable drugs and driving (Table III).

A majority from both cities thought traffic accidents were preventable. However, more respondents from Harstad thought traffic accidents were preventable by public action, or preventable by individual precaution (Table IV).

Table III. Percentage of respondents* reporting frequency of discussions in the family/among friends during the last year about traffic safety issues** by residency.

	Discussed often/quite often†					
	Harstad (N=723)	Trondheim (N=714)	Unadjusted		Adjusted ††	
Safety issue in driving	%	%	χ^2	p-value	Wald χ^2	p-value
Alcohol	62,5	51,3	17,7	0.000	9.3	0.002
Drugs	26.2	21.4	4.2	0.041	0.6	0.446
Speeding	77.1	69.4	10.4	0.001	7.0	0.008
Children's safety	77.0	67.4	15.7	<0.001	12.8	<0.001

* N varied for the four questions. „Don't know" varied from 1.3 % to 4.0 % of total for each.
** Alcohol and driving, drugs and driving, speeding and children's safety in traffic.
† The variable «frequency of discussion» was dichotomised. Often/quite often is shown. Never/seldom may be calculated.
†† Adjusted for age, gender and level of education.

Table IV. Percentage of respondents* reporting some perceptions of traffic accident preventability by residency.

	Disagree**					
	Harstad (n=723)	Trondheim (n=714)	Unadjusted		Adjusted †	
Accidents are:	%	%	χ^2	p-value	Wald χ^2	p-value
Inevitable	89.2	86.4	2.20	0.138	7.5	0.006
Preventable by public action	4.8	10.0	9.31	0.002	11.6	0.001
Preventable by individual precaution	5.1	8.0	4.49	0.034	3.7	0.056

* N varied for the three questions. „Don't know" varied from 2.1 % to 5.5 % of total for each.
** Completely, or to some extent. Regarding the statement at hand, the participant was invited to agree completely, agree to some extent, disagree completely, or disagree to some extent. The variable was dichotomised.
† Adjusted for age, gender and level of education.

Preference of information by administrative level

The perceived importance of traffic safety information by different administrative levels (school district, municipality, county and national levels) differed slightly in the two cities with a tendency towards preference for local information in Harstad (n.s.)(data not shown). The combined data for the two cities show a preference for local data (Table V).

Evaluation of the Traffic Injury Report system

Of the 723 respondents from Harstad, 56.0 % reported to have acquired information, or good advice, about traffic safety from the TIRs; 42.6 % reported that information acquired from the TIRs was the reason for starting discussions about problems connected with safety in traffic. The distributions of these respondent categories varied somewhat by age groups, but less by years of education (Figures 2-3).

Table V. Ranked indication, with regard to road traffic, of preferred level of information to improve road safety in the community, N=1437*, shown in %.

		School district	Munucipality	Country	Whole country
Most	important	51.6	35.4	6.1	6.6
Second	"	21.0	48.2	17.4	7.9
Third	"	9.8	6.8	59.4	12.3
Least	"	10.2	2.6	8.8	64.5

* Harstad and Trondheim combined. Approximately 8% answered "don't know" for each question.

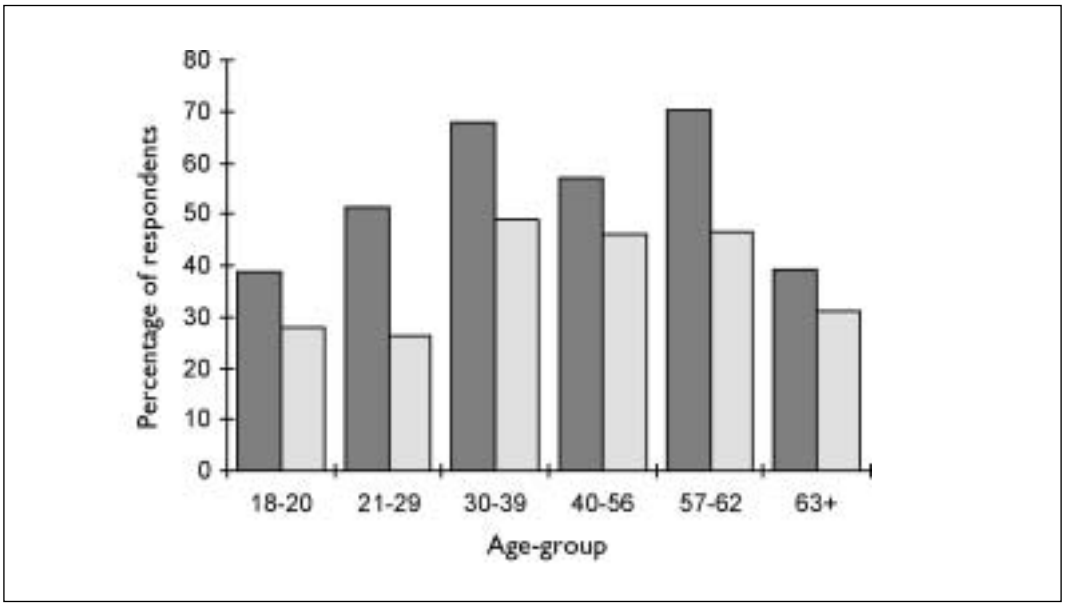

Figure 2. Evaluation of impact from Traffic Injury Report (TIR) in six different age-groups of Harstad residents (n=723). Two categories of impact are shown in per cent of respondents for each age-group. Acquired information, or good advice, from TIR (dark gray), TIR-initiated discussions about driving and alcohol and/or drugs/speeding/children's safety in traffic (light gray).

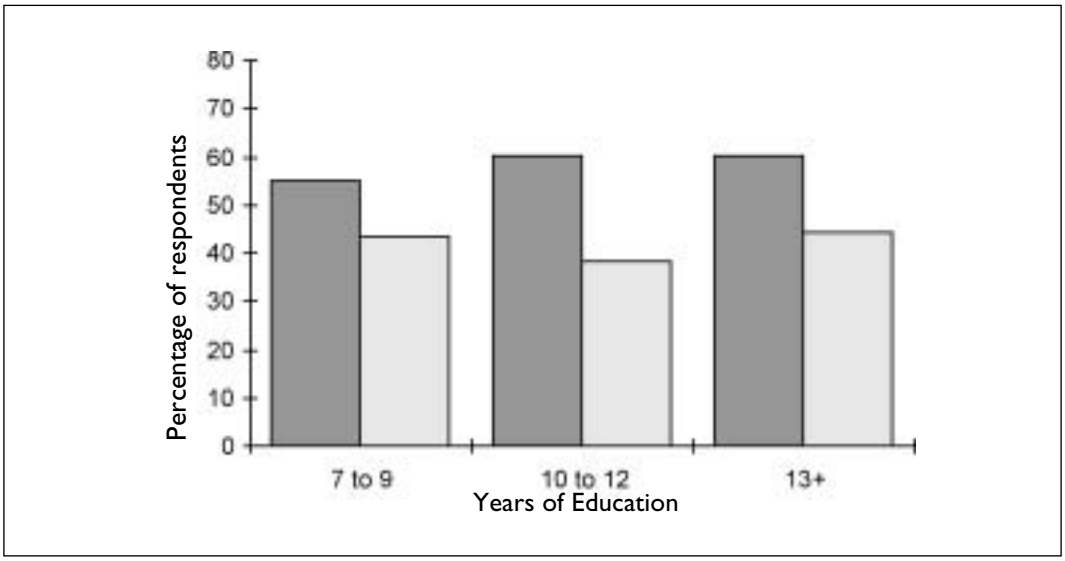

Figure 3. Evaluation of impact from Traffic Injury Report (TIR) by three different levels of education in Harstad residents (n=686), years of education range from 7 to 20 years (respondents outside this range excluded).Two categories of impact are shown in per cent of respondents for each level of education. Acquired information, or good advice, from TIR (dark gray), TIR-initiated discussions about driving and alcohol and/or drugs/speeding/children's safety in traffic (light gray).

DISCUSSION

The reported reduction in traffic injury rates in young Harstad residents indicates an effective and sustainable injury prevention program. Threats to the validity of this statement are alternative explanations for this reduction.

Secular trend and other threats

As national figures for secular trend are incomplete, the Trondheim overall rates may serve as a substitute. The trends for the intervention and reference cities differ (Table II), and suggest that secular trend is not a threat to validity.

Alternative explanations for the observed rate reductions in Harstad could be changes in car ownership rate, traffic density, travelling habits, weather, registration effect and regression to the mean effect. These and other threats to validity have been discussed previously (3,4) and were not considered to be probable alternative explanations.

Knowledge and attitudes

The present study seems to indicate significantly higher scores in Harstad compared to Trondheim on the awareness about three different traffic safety issues (Table III) and positive attitudes towards traffic accident preventability (Table IV).

This could be interpreted as intervention-induced higher levels of awareness and perceptions of community and individual coping skills in Harstad compared to Trondheim. However, there is substantial evidence that changes in knowledge and attitudes do not necessarily correlate with changes in actual behaviour and, thus, with a reduction in injuries (9).

It has been proposed that the word accident should be avoided by researchers because of connotations of unavoidability (20). However, the word is widely used by the public and a US survey showed that 83% of respondents associated the word accident with preventability (21). The present study has similar findings. Among the respondents, 86,4% in Trondheim and 89,2 % in Harstad associated accidents with preventability. Using the word accident may not be as counter-productive to prevention as previously thought.

Data preferences

When community-based traffic safety is promoted, data on the local injury panorama is essential (3-4). However, most communities have no access to adequate local data. There are several reasons for this. Firstly, the prevention of traffic injury in most countries suffers from the short-comings of low official data reporting. The completeness of police/official reporting is internationally described to range between 23% and 77% (3). In an earlier study, we found that police records counted less than a third of the patients treated for road traffic injuries by the health services (3). Secondly, the data are not broken down to municipal, or school district levels, in order to inspire local action for better road safety; most local initiatives have to be based on anecdotal, rather than epidemiological evidence.

Most reports and press releases about statistics and trends on road traffic injuries inadequately describe the situation at national, or other high administrative levels (e.g. regions or counties). Whereas such information may be valuable for central road safety authorities (presuming a relatively constant reporting rate), it is of little, or no, value to the local practitioners of injury prevention. The present study shows that preference for local, compared to central traffic safety information, was marked in both cities (Table V). This should be kept in mind when planning future traffic safety information campaigns.

Impact of the Traffic Injury Report

It was surprising to find that as many as 56 per cent of the respondents had acquired information, or good advice, about traffic safety from the TIRs. However, the impact varied in different age groups. An important target for traffic safety promotion is the driver of a motor vehicle, who is obviously the key individual in collisions concerning child pedestrians, or bicyclists. While the youngest drivers had the highest injury rates from motor vehicle crashes (3), the TIRs influenced 40 %. Nevertheless, they were the age group least affected (Fig. 2). This is in accordance with earlier findings showing that both the promotion of voluntary behavioural change and laws aimed at changing behaviour tend to be least effective among the very groups at highest risk of injury (22). Another example of this phenomenon is the finding that intoxicated drivers and teenagers have the lowest seat belt use (22).

The impact of the TIRs seemed to be greatest among respondents from the third to the beginning of the sixth decade of life (Fig. 2). The effect was greater in women than in men (data not shown). This preponderance might be explained by these age groups' concern for their children, or grandchildren, moving about in a dangerous traffic environment - a concern that dwindles with oncoming high age?

Furthermore, the effect of the TIRs seemed to be evenly distributed over socio-economic classes, based on years of education (Fig. 3). This is something to be preferred in an egalitarian society and from a public health point of view.

Agenda setting and program sustainability

The exact amount of credit for injury rate reduction attributable to the TIRs is impossible to ascertain. However, the TIRs became a constant reminder appearing in peoples mailboxes. In addition, most of the 26 TIRs that were issued sparked reports in newspapers, or on local television. Agenda setting and program sustainability was thus supported by an ongoing data collection system that disseminated updated medical and geographical information on the community traffic injury profile. Local pressure groups, particularly the parent-teacher association, used the geographical data to justify demands for investments in safer physical environments for children in traffic. The Harstad road planners and police have increasingly made the physical environment safer during the study decade, by (i) constructing separate pedestrian and cyclist roadways, (ii) installing speed-reducing road impediments (iii) treating black spots and by reducing and enforcing speed limits.

Non-responders

The question of non-responders (over 50 %) remains to be addressed. The whole census-drawn sample and the non-responders were compared with regard to residency and the possible confounders: age, sex and marital status. This analysis showed that the census-drawn sample and responders were quite similar with respect to the above-mentioned possible confounders. This does not guarantee that our samples are truly representative of the Harstad population with regard to the studied variables. However, because similar persons seem to be responders and non-responders, the inferences in the present paper about the impact of the TIR system in Harstad can be made.

Implications for prevention

The present study demonstrates that a community-based program for reducing traffic injuries in children may be effective, in the long-term, when several prevention strategies are implemented. In such multi-faceted programs, periodical publishing and wide dissemination of written information with local injury data may have an impact on more than half of the population and may be an important means of enhancing the sustainability of such a traffic safety program. Local data may serve as the locomotive that keeps the injury prevention train on its tracks.

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